



## Oligodynamic Effects Copper Against Water Borne Pathogens

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### *Abstract*

*The present study on the oligodynamic property of copper against waterborne pathogens. The micro organisms were isolated from the water samples, by serial dilution of the water samples and then plating them onto a melted nutrient agar plate. After incubation, the colonies appear on selective agar plate which is noted and were simple stained, Gram stained, Enzymatic hydrolysis (Starch, Lipid, Casein), Carbohydrate fermentation on various sugars (sucrose, glucose, lactose), Triple sugar iron test, IMVIC test, H<sub>2</sub>S test, Urease test, Nitrate reduction.*

**Keywords:** Antimicrobial activity; Copper; Waterborne pathogen.

### 1. INTRODUCTION

Oligodynamic action is the term given to the roughly 120 year old discovery that certain metals are toxic to bacteria and some other microbes such as algae, molds, spores, fungi and so on. In traditional methods, ornaments made up of oligodynamic metals are used, that they will get rid of more bacteria and so on pots made up of oligodynamic metals are used for storing drinking water as it will purify it within hours. It was discovered by a swiss scientist Karl Wilhelm Von Nageliin 1893. The antimicrobial effect is shown by ions of Mercury, Silver, Copper, Iron, Lead, Zinc, Bismuth, Gold, Brass, Aluminium, and other metals and their concentration for this antimicrobial effect is very small (Jain, 1990). Oligodynamic effect is the effectiveness of heavy metals as germicidals is due to the higher cellular proteins for metallic ions. Bacterial cells die due to the cumulative effects of ions within the cells, even if the concentration of ions in a solution is miniscule (Benson, 2002)

The exact mechanism causing oligodynamic action is still unaware to science but some data regarding the silver justifies this dilemma. Silver inactivates enzymes by reacting with the Sulfhydryl groups to form silver sulphides. It reacts with amino-, carboxyl-, phosphate-, and imidazole- groups and it diminishes the activities of Lactate dehydrogenase and glutathione peroxidase (Lentech, 2010). Metals destruct the organisms on skin from entering in. A metal bind and destruct cell membranes, disables protein and inhibits enzyme activities (Thurman and Gerba, 1988). An Oligodynamic metal offers profound immune

benefits because of its ability to intervene with bacteria in three key ways almost simultaneously.

The studies made by Hambidge concluded that positively charged ion distorts the negatively charged cell wall by binding with it (Hambidge, 2001). On binding it causes cell lysis and death (Bitton and Frieheffer, 1977).

### 2. MATERIALS & METHODS

The water sample is serially diluted in 9ml distilled water for reducing microbial content of water sample. About 1ml of serially diluted sample from 10<sup>-4</sup> to 10<sup>-6</sup> was poured in to sterile petri plate. Then the sterilized molten cooled nutrient agar medium was poured in to petri plates containing serially diluted sample before the solidification of medium, the plates were rotated clockwise and anticlockwise direction for thorough mixing of medium. The Copper coin sterilized by soaking the coins in ethanol for 5 to 10 minutes and then dried in autoclave for 10 minutes. Now the coins are ready for work devoid of contamination. After the solidification the plates were inverted and incubated at 37°C. The colonies of different morphologies on nutrient agar media were selected and streaked on selective media. The smear of nutrient broth cultures were made on the slide, air dried, and heat fixed and stained with single reagent containing positively charged chromogen for observing the shape. Then it is washed, dried and observed under microscope. The smear of nutrient broth cultures were made, air dried and heat fixed, then it was treated with gram's reagents. First, the smear was treated with crystal violet for 1 minute. After washing, it was

flooded with gram's Iodine again then washing it was decolorized with 95% ethanol for 30 seconds and washed. Then it was treated with safranin for 1 minute. Then it was washed, blot dried and observe under microscope.

### 3. OBSERVATIONS

The present study on the antimicrobial property of Copper against waterborne pathogens. The organisms were isolated from water samples, by serial dilution of the water samples and then plating them onto a melted nutrient agar plate. After incubation, the colonies appear on selective agar plate which is noted and were simple stained, Gram stained. The rate at which the materials under study can eliminate the microbes in water. The metal Copper show the fastest rate of reduction of microbes. Copper is more reactive. However among the effectiveness and susceptibility of metals, copper pots is more bactericidal. Copper pots showed the total reduction in microbial load within 4hrs while 100% load reduction was obtained after 8hrs and 24hrs. The rate at which the materials under study can eliminate the microbes, *Escherichia coli*, *Salmonella typhi* and *Vibrio cholerae* from contaminated water samples. All water pathogens chosen for this study were inhibited within maximum holding time of water. However effectiveness Copper and susceptibility shown by individual bacteria were different in each case. Copper pots showed the reduction time while holding for removal of microbes.

### 4. DISCUSSIONS & CONCLUSION

Traditionally, it has been believed that drinking water stored in certain metal pots is comparatively less contaminated with microbes indicating the potential role of the pot material in decreasing bacterial density such that jewels made of metals such as Silver, Gold, Gold plated on Zinc and Copper are found to be more bactericidal against skin borne pathogens (Slawson *et al.* 1992). In the previous work of Rajani Shresta *et al.* (2010), found that Copper pots were found to be very effective on *Escherichia coli*, than Steel and Aluminium pots. In this present study, the Copper and Brass pots are more effective to water borne pathogens

such as *Escherichia coli*, *Vibrio cholerae* and *Salmonella typhi*. Then the Gold, Silver and Gold plated on Zinc is more bactericidal on skin borne pathogens. In this study, the Copper was found to be more effective. So to enhance oligo dynamic effect, Copper and other oligo dynamic metal can be combined with Silver resulting in a synergistic disinfection effect on bacterial cells (Hambidge, 2001). Effects of Silver ions on normal mammalian cells are minimal (Berger *et al.* 1976).

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